Injury Potential Testing of Suited Occupants During Dynamic Spacecraft Flight Phases

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Abstract

In support of the Constellation Program, a space-suit architecture was envisioned for support of Launch, Entry, Abort, Micro-g EVA, Post Landing crew operations, and under emergency conditions, survival. This space suit architecture is unique in comparison to previous launch, entry, and abort (LEA) suit architectures in that it utilized rigid mobility elements in the scye and the upper arm regions. The suit architecture also employed rigid thigh disconnect elements to allow for quick disconnect functionality above the knee which allowed for commonality of the lower portion of the suit across two suit configurations. This suit architecture was designed to interface with the Orion seat subsystem, which includes seat components, lateral supports, and restraints. Due to this unique configuration of spacesuit mobility elements, combined with the need to provide occupant protection during dynamic landing events, risks were identified with potential injury due to the suit characteristics described above. To address the risk concerns, a test series was developed to evaluate the likelihood and consequences of these potential issues. Testing included use of Anthropomorphic Test Devices (ATDs), Post Mortem Human Subjects (PMHS), and representative seat/suit hardware in combination with high linear acceleration events. The ensuing treatment focuses on detailed results of the testing that has been conducted under this test series thus far.